

Epifoliar Fungi of Singapore

D. R. REYNOLDS

University of California Herbarium
Berkeley, California USA 94720

Abstract

This article is a discussion of the known epifoliar fungi from Singapore found in several worldwide Herbaria, and those collected by the author. Fifty species in 15 genera are reviewed and annotated. An additional twenty new combinations in *Setameliola* are proposed to contain *Meliola* species with an ascocarp bearing straight setae. Critical attention is given to the species concepts in *Meliola* and *Polychaeton*.

Introduction

Ecologically, the epifoliar fungi are stratified in the tropical canopy (Reynolds, 1972; Gilbert *et al.*, 2007) with a prevalence in the understory where abundant hosts support a greater number and diversity of fungi. Environmental conditions affecting spatial distributions are sites in the dark canopy and openness.

Epifoliar fungi are specialized as nutritional guilds found only on the surface of living plants, particularly the leaves (Gilbert *et al.*, 2007). Several, principally, Ascomycete lineages that together comprise a polyphyletic group, have evolved into this habitat as four nutritional guilds: saprobes, plant parasites, fungal parasites, and lichenized species. With the exception of lichenized species, all share common adaptive morphological traits including a dark, melanoid pigmentation and reproduction by ascospores and mitospores. For the non-lichenized taxa, the habits and morphological traits are convergent plesiosynapsies that distinguish groups of fungi at lower clade levels. In contrast, lichenized fungi have acquired the epifoliar habit at higher clade levels equivalent to genus or species (Lücking, 2002). The Singapore lichenized species have been reviewed by Sipman (2003a, 2003b, 2007).

Thaung (2006) observed that one distribution pattern of epifoliar fungi is comparable with the phytogeography of the Indo-Malayan Biogeographic Realm with tropical rainforests, (mongabay.com/0102.htm). He suggested that the radiation pattern indicates an Indo-Himalayan origin with dispersal southward into SEAsia, including Singapore.

The information on currently known epifoliar fungi from Singapore is obtained from several worldwide Herbaria, and those collected by the author in Singapore in 2007. The epifoliar fungi from Singapore are historically known from the Fungi Malayana exsiccatum assembled by C.F. Baker from 1916-1920. Numbers 401- 500 of Century V were collected in Singapore out of the total 600 specimens. Twenty-two Singapore species of epifoliar ascomycetes were identified; 12 of them were described as new by Saccardo (1918). The exsiccatum specimens are currently known to be curated in Herbaria BPI, CUP, FH, PC, S and UC (Pfister, 1985; Holmgren & Holmgren, 1998). Lim (1975) published a list of 13 epifoliar species from Singapore; the cited collections are currently unavailable for reexamination.

The list of taxa is as follows –

1. *Asteridiella* McAlpine, Proc. Linn. Soc. New South Wales 187 (1897) 38. Ascospores 4 septate, brown; asci evanescent; ascocarp superficial, globose, glabrous; mycelium superficial, brown, septate, branched, aseptose, hyphopodia alternate.

1.1. *Asteridiella umirayensis* (Yates) Hansford, Sydowia 10 (1957) 51.

-*Meliola umirayensis* Yates, Philipp. Jour. Sci. Bot. 13 (1918) 370;

-*Irenia umirayensis* (Yates) Hansford, Proc. Linn. Soc. London 157 (1946) 170.

-*Irenia bakeriana* Hansford, Proce. Linn. Soc. London 157 (1946) 169.

Ascospores 4 septate, oblong to ellipsoid, 36-45 x 14-16 µm. Ascocarp scattered, to 180µm diameter, surface cells conoid projecting to 15µm. Mycelium to 3mm diameter, hyphopodia alternate, ampulliform.

Specimen reported: C.F. Baker Fungi Malayana 455, determined as *Meliola reticulate* Karsten & Roumeguère; BPI 696686-87, Flora of Singapore 5796, Coll. J.J. Chupp, 2 Jul 1920.

Illustration: Hansford, 1963.

Distribution: Java, Philippines, Singapore.

2. *Asteriua* Lévillé, Ann. École Natl. Agric. Montpellier (1845) 59.

Ascospores brown, 1 septate, ellipsoid-oblong; Asci fissitunicate, aparaphysate; Ascocarp dimidiate, circular, radiate, astomate; Mycelium brown, with hyphopodia or node cells.

2.1. *Asterina erebia* Sydow, Ann. Mycol. 25 (1927) 59, *sensu* Stevens & Ryan, Ill. Biol.

Monogr. (1939) 70. **Fig. A.**

Ascospores $26\text{--}32 \times 12\text{--}16 \mu\text{m}$. Ascus $55\text{--}65 \mu\text{m}$. Ascocarp $150\text{--}300 \mu\text{m}$: hyphopodia alternate, 2-celled.

Specimens reported: Singapore. Bukit Timah Nature Reserve, Oct 2007. DRR 15, 16, 17, 18.

Distribution: Singapore.

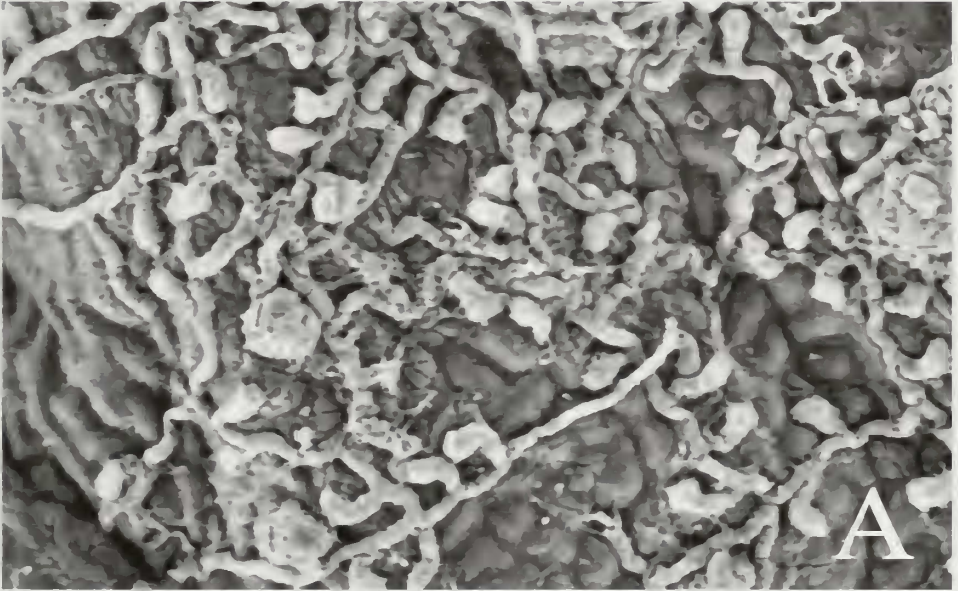


Figure A. *Asterina erebia* Sydow. Mycelium with hyphopodia and ascocarps [from DRR Singapore 16: line = $20 \mu\text{m}$].

2.2. *Asterina singaporensis* Sydow, Ann. Mycol. 18 (1920) 159. **Fig. B.**

Ascospores $16\text{--}20 \times 6\text{--}8 \mu\text{m}$. Asci $30\text{--}40 \mu\text{m}$. Ascocarp $80\text{--}110 \mu\text{m}$ diameter. Colonies epiphyllous, 2–5 mm diameter, hyphopodia dispersed rarely opposite, $10\text{--}15 \mu\text{m}$ long.

Specimen reported: C.F. Baker Fungi Malayana 401. Holotype at UC. Sydow and Sydow (1917) noted that this specimen was distributed as *Asterina trachycarpa* Sydow (see also Saccardo, 1918).

Distribution: Singapore.



Figure B. *Asterina singaporensis* Sydw. The dimidiate ascocarp is formed beneath hyphopodate hyphae [from C.F. Baker *Fungi Malayana* 301; line = 10 μ m].

3. *Ciferriusia* Batista in Batista & Ciferri, Sydowia Beih. 3 (1962) 17.

Ascospore 3 transseptate. Asci fissitunicate, paraphysate. Ascocarp developed beneath a mycelia pellicle, without setae. Mycelium hyaline to subhyaline, septate.

3.1. *Ciferriusia orientalis* Batista & Costa in Batista & Ciferri, Sydowia Beih. 3 (1962) 17.

Ascocarp globose-depressed, with a mycelical shield, 90-180 μ m diameter, ostiolate. Asci 40-60

μ m. Ascospores clavate, 3-transversely septate, hyaline, 15-20 x 4-5 μ m.

Specimen collected: Singapore Botanical Garden, Oct 2007, DRR 4.

Illustration: Batista & Ciferri, 1962: Fig. 11.

Distribution: Philippines, Singapore.

Note: Arx and Müller (1975) considered *Ciferriusia* to be a synonym of *Yatesula* H. Sydow & P. Sydow, which has muriform ascospores.

4. *Ellisiodothis* Theissen, Ann. Mycol. 12 (1914) 73.

Ascospores hyaline, unicellular. Ascus fissitunicate, pseudoparaphysate, 45-50 x 16 μ m; Ascocarp hypostomatic, superficial, dimidiate, nonradiate, dark.

This genus is closely related to *Microdothella* Sydow and *Myiocopron* Spegazzini. It was suggested as a synonym of the latter taxon by A. Sivanesan (see Kirk, 2008).

4.1. *Ellisiodothis grammatophylli* (Saccardo) Sydow & Sydow, Ann. Mycol. 18 (1920) 185.

-*Microthyrium grammatophylli* Saccardo, Bull. Orto Bot. Regia Univ. Napoli 6 (1918) 49.

-*Ellisiodothis grammatophylli* Sydow, Ann. Mycol. 18 (1920) 134.

Ascospores 22 x 6 µm. Ascus 45-50 x 16 µm. Ascocarp 325-450 µm.

Specimen reported: C.F. Baker Fungi Malayana 467. Holotype at PAD and isotype, UC.

Distribution: Singapore.

5. *Lembosia* Lévêillé, Ann. Sci. Nat. 3 (1845) 58.

Ascospores 1 septate, brown. Asci spherical, fissitunicate, paraphysate. Ascocarp long or linear forming, X or Y forming, with a longitudinal slit. Mycelium superficial, hyphae with lateral or intercalary hyphopodia, hypostroma or innate hyphae absent

5.1. *Lembosia hormosiana* Saccardo, Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 52. Ascospores 17-16 x 15-6.5 µm. Ascus 35-40 x 18-20 µm. Ascocarp 235-400 x 90 µm.

Specimen reported: C.F. Baker Fungi Malayana 443. Holotype at PAD and isotype, UC.

Distribution: Singapore.

5.2. *Lembosia pandani* (Rostafinski) Theissen, Ann. Mycol. 11 (1913) 457.

-*Asterina pandani* Rostafinski, Bot. Tidsskr. 24 (1902) 361.

Ascospores 28-38 x 24-26 µm. Ascus 28-30 x 24-26µm. Ascocarp 350-850 µm.

Specimen reported: C.F. Baker Fungi Malayana 444. Holotype at FH and isotype, SING. *Distribution:* Philippines, Singapore.

6. *Lembosina* Theissen, Ann. Mycol. 11 (1913) 437.

Ascospores brown, 1-septate. Asci fissitunicate, paraphysate. Ascocarp superficial, elongated or linear, *textura radiate*, opening by a longitudinal slit.

Mycelium subcuticular or intraepidermal, crustose stroma present. Hyphae, septate, without hyphopodia, forming hypostroma between the epidermis and cuticle.

6.1. *Lembosina heptapleuri* (Saccardo) v. Arx in Arx & Müller, Studies in Mycol. 9 (1962) 123.

-*Lembosia heptapleuri* Saccardo, Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 52;

-*Echidnodes heptapleuri* (Saccardo) H. Sydow & P. Sydow, Ann. Mycol. 18 (1921) 185.

Ascospores 16 x 5 µm. Ascus 40 x 12 µm. Ascocarp 300-1000 x 100-120 µm.

Specimen reported: C.F. Baker Fungi Malayana 442, as *Lembosia heptapleuri*. Holotype at PAD and isotype, UC.

Distribution: Singapore.

7. *Meliola* Fries emend. Mibey & Hawksworth, Mycol. Pap. 174 (1997) 23.

- *Amphitrichum* Nees ex Sprenger, Pl. Crypt. Trop. (1820) 46 *pro parte sensu* Hansford (1961).

- *Asteridium* Saccardo, Syll. Fung. 1 (1882) 49.

- *Courturaea* Castagne In Fries, Summ. Veg. Scandl. (1846) 407.

- *Meliola* Fries emend. Bornet, Ann. Sci. Nat III: 16 (1851) 267.

- *Meliola* Fries, Syst. Orb. Veg. (1825) 111.

- *Mycothecium* Kunze ex Fries, Syst. Mycol. 3 (1829) 232.

- *Sphaeria* Fries, Syst. Orb. Veg. (1823) 513, *pro parte sensu* Hansford (1961).

Ascospores darkly pigmented, 3-4 transseptate; Ascus unitunicate, uniformly thin-walled; Ascocarp globose, glabrous. Mycelium superficial, comprised of darkly pigmented, septate, setose hyphae; capitate hyphopodia alternate or unilateral, opposite or mixed opposite and alternate. Asexual reproduction, when present, by single phialides producing unicellular, hyaline mitospores.

Meliola was first described by Fries (1825) with a single species and currently includes 2957 taxa (Kirk, 2008). The genus was one of five genera recognized in the Meliolineae by Hansford (1961). This lineage was recognized as the Meliolaceae by Dennis (1968, 1970), Stevens (1927, 1928), and Stevenson (1975), and Meliolales by Alexopoulos *et al.* (1996) and Müller and Arx (1973). Luttrell (1989) placed *Meliola* in the Meliolales of the Pyrenomycetes, which was sustained in a phylogeny discovered by Saenz and Taylor (1999).

A careful and detailed monographic study of 1814 taxa in the genus was undertaken by Hansford (1961). Nonetheless, a more than double

proliferation of names has been inadvertently manifested with Hansford's unaccountable arrangement of the species according to the families of the host plants on which they occurred. Subsequent new taxa have been described because of the compartmentalization introduced with the associated vascular plant family as a plesiomorphic character. A comparison of species descriptions that disregards this character demonstrates the taxonomic redundancy. This artificial classification is underscored in the Hansford (1961) monograph by some species listed as occurring on members of more than one vascular plant family and by the recognition of species in which the host is unknown. The Hansford (1961) approach also implies a co-evolution of *Meliola* with angiosperms at the family level, which is not supported by distribution patterns on a phylogenetic clade for the latter.

The consequence of Hansford's *Meliola* species concept is a high potential for a redescription of the same fungus several times. An example is the excessive number of proliferation of uncritically described species by subsequent workers (Hosagoudar 1994, 1996, 2000; Hosagoudar *et al.*, 1997; Hosagoudar and Agarwal, 2008; Hu, 1996, 1999; and Mibey and Hawksworth 1997; Rodriguez 2006). This report does not recognize the associated vascular plant host as a plesiomorphic character.

The species concept of *Meliola* recognized here does not recognize the associated vascular plant host as a plesiomorphic character, although the host range appears to be limited for some clades (Stevens, 1926; Ciferri, 1954; Rodriguez, 2001). The consequence is a description of the same fungus several times because of the host affiliation.

A useful device for an assessment of a *Meliola* species was introduced by Beeli (1920). A numerical code was derived from a set of eight character states with from 3 to 6 variables. The Beeli Formula was revised by Stevens (1927, 1928), Hansford (1961) and Farr (1971). Some authors (Mibey and Hawksworth, 1977) criticize the Beeli Formula as not representing all features and thus was said to be diagnostically lacking. The occurrence of the same Beeli Formula for a group of species was dismissed as insignificant because of the supposed value of other features that would purportedly separate species. These include finite distinctions such as small variations in ascospore size and hyphal or hyphopodial cell size. Most of the features they (Mibey and Hawksworth, 1977) would utilize in the species concept for critical separation of taxa are highly variable and thus unreliable in species recognition, except as a promulgation.

I believe that Beeli recognized the core characters that comprise a species concept for *Meliola*. The continuous character delimitations reflect natural size ranges. Furthermore I regard all putative taxa with a similar Beeli Formula to represent the same or a group of closely related species. Phylogenetically, a large number of overlapping names have been proposed

for the termini of a monophyletic lineage with morphological expression better represented by the Beeli Formula than the minutial variations of these same characters as exemplified by Mibey and Hawksworth (1997).

This predominately tropical genus first appeared in the fossil record in the Eocene (Dilcher, 1965), at a time in the Cretaceous when associated angiosperm hosts were diversifying from a Triassic origin (Taylor *et al.*, 2009). The fossilized, melanoid ascocarp walls of this taxon and other foliicolous ascomycetes are well preserved on compressed leaf cuticles. A lineage older than the Eocene is suggested by the remarkable similarity of specimens to extant species, although the centrum was rarely preserved.

7.1. ***Meliola aethiops*** Saccardo, Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 41.

-*Meliola aglaina* Hansford, Sydowia 9, (1955) 59.

-*Meliola ekebergiae* Hansford, J. Linn. Soc. Bot. 51 (1937) 274.

-*Meliola kauaiensis* Stevens, Bernice P. Bishop Mus. Bull. 19 (1925) 39.

-*Meliola mataybae* Stevens, Ann. Mycol. 26 (1928) 228;

-*Meliola capensis* (Klatchbrenner & Curtis) Theissen var *mataybae* (Stevens) Hansford,

Sydowia Beih. 2 (1961) 447.

-*Meliola nicaraguensis* Spegazzini, Bol. Acad. Nac. Cien. Córdoba 26 (1926) 378.

-*Meliola opposite* Sydow var *africana* Hansford, Sydowia Beih. 2 (1961) 411.

Ascospore $32-45 \times 11 \mu\text{m}$. Ascocarp to $180 \mu\text{m}$ diameter. Mycelium to 3 mm diameter;

capitate hyphodia opposite or alternate, ampulliform; mycelial setae grouped around ascocarp, straight, simple, $280 \mu\text{m}$.

Beeli Formula: 31123221

Specimen reported: C.F. Baker *Fungi Malayana* 449, determined as *Meliola aethiops*. Holotype at SING (#33777). A Singapore specimen was cited as *Meliola aethiops* by Lim (1975).

Illustration: Hansford, 1963.

Distribution: Philippines, Singapore.

7.2. ***Meliola citricola*** Sydow, Ann. Mycol. 15 (1917) 183.

[IMI Descriptions of Fungi and Bacteria 2006, 168, Sheet 1672].

- Meliola bussei* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1997) 32.
 - Meliola khayae* Hansford var *minor* Hansford & Deighton Mycol. Pap. 23 (1948) 43.
 - Meliola ostryodemidis* Hansford & Deighton. Mycol. 3 (1948) 34.
 - Meliola ostryodemidis* Hansford & Deighton var *leptoderridis* Hansford & Deighton 1948. Mycol. Pap. 23 (1948) 35.
 - Meliola stizolobii* Hansford & Deighton var *desmodii-salicifolii* Hansford & Deighton, Mycol. Pap. CMI 23 (1948) 31.
- Ascospores $30\text{--}48\text{ }\mu\text{m} \times 9\text{--}19\text{ }\mu\text{m}$. Ascocarp to $140\text{--}170\text{ }\mu\text{m}$ diameter. Mycelium to 5 mm diameter; capitate hyphopodia alternate, opposite, straight to antrorse. Mycelial setae scattered or grouped around ascocarp, $160\text{--}800\text{ }\mu\text{m}$. *Briania phialides* (Reynolds, 1989b) sometimes present.

Beeli Formula: 31334223

Specimens reported: Hansford (1961) cites a Singapore collection, *Chupp 5949*, which is curated in SING as #38557 and #96896; they are determined as *Meliola*. An addition specimen, *Baker 1627*, is also cited (Type: Herb. PBS 23747).

Illustrations: Stevens, 1928; Hansford, 1963; Lim, 1975; Hosgoudar & Agarwal, 2008.

Distribution: Borneo, Philippines, Singapore, Sumatra, Taiwan.

- 7.3. *Meliola cylindropoda* Doidge, Trans. Roy. Soc. South Africa 8 (1920) 138.
- Irenina mangostana* (Saccardo) Stevens, Ann. Mycol. 25 (1927) 457.
 - Meliola araliicola* Yamamoto, Trans. Nat. Hist. Soc. Formosa 31 (1941) 224.
 - Meliola euchrestiae* Yamamoto, Trans. Nat. Hist. Soc. Formosa 31 (1941) 226.
 - Meliola eugeniae-jamboloidis* Hansford var *paulensis* Hansford, Sydowia 9 (1955) 62.
 - Meliola garciniae* Yates var *mangostana* (Saccardo) Hansford, Proc. Linn. Soc. London 160 (1948) 120.
 - Meliola littoralis* Sydow, Bothalia 2 (1928) 462.
 - Meliola mangostana* Saccardo, Bull. Ort. Bot. Napoli 6 (1921) 42.
 - Meliola plumbaginis* Hansford & Stevens, J. Linnean Soc. London 51 (1937) 280.
 - Meliola tectae* Hansford var *toddaliae-asiaticae* Hansford, Proc. Linn. Soc. London 153 (1941) 11.

Ascospores $38-44\ \mu\text{m} \times 15-17\ \mu\text{m}$. Ascocarp to $240\ \mu\text{m}$ diameter. Mycelium to 6 mm diameter, capitate hyphopodia alternate, straight or bent. Mycelial setae scattered, to $1110\ \mu\text{m}$.

Beeli Formula: 31114233

Specimen reported: C.F. Baker *Fungi Malayana* 453. This is the type specimen for *M. mangostana* (Herb. SING 33779).

Illustration: Hansford, 1963.

Distribution: Philippines, Singapore, Taiwan.

7.4. *Meliola fagraeae* Sydow & P. Sydow, Ann. Mycol. 12 (1914) 549.

-*Meliola mannavanensis* Hosagoudar, C.K. Biju, Baram & Crane. Mycotaxon 76 (2000) 302.

-*Meliola rajamalaensis* Hosagoudar, C. K. Biju & Abraham. Nova Hedwigia 80 (2005) 493.

Ascospores $41-55\ \mu\text{m} \times 15-19\ \mu\text{m}$. Ascocarp to $225\ \mu\text{m}$ diameter. Mycelium to 3mm diameter, capitate hyphopodia alternate, straight. Mycelial setae numerous, scattered, straight or flexuous, to $360\ \mu\text{m}$.

Beeli Formula: 31215232

Specimen reported: BO 5354, reported in Hansford 1961:525.

Illustration: Hansford, 1963.

Distribution: Philippines, Singapore, Sumatra

7.5. *Meliola garciniae* Yates, Philipp. Journ. Sci. Bot. 13 (1918) 369.

-*Meliola dognyensis* Huguenin, Rev. Mycol. 34 (1969) 52.

-*Meliola kisubiensis* Hansford, var. *peleicola* Hansford, Sydowia 9 (1955) 43.

-*Meliola kydia* Saccardo Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 13.

-*Meliola mauritiana* Hansford, Sydowia 9 (1955) 20.

-*Meliola megalochaeta* Sydow, Philipp. Journ. Sci. 21 (1932) 135.

-*Meliola teke* Hansford, Proc. Linnean Soc. Lond. 157 (1946) 180.

Ascospores $41-59 \times 15-25\ \mu\text{m}$. Ascocarp $180-360\ \mu\text{m}$ diameter. Mycelium (3) 5-10 mm diameter; capitate hyphopodia opposite or alternate; mycelia setae simple, entire, acute to obtuse or dentate, $325-1600\ \mu\text{m}$.

Beeli Formula: 31115334

Specimen reported: C.F. Baker Fungi Malayana 450, determined as *Meliola kydia*. Holotype at PAD and isotype, UC.

Illustration: Hansford, 1963.

Distribution: Amboina, Borneo, Java, Philippines, Singapore, Vietnam.

7.6. *Meliola heterodonta* Sydow, Ann. Mycol. 14 (1916) 357.

-*Meliola columbiensis* Hansford, Sydowia 9 (1955) 61.

-*Meliola justiciae* Hansford, Journ. Linn. Soc. Lond. 31 (1938) 541.

-*Meliola micropoda* Hansford, Proc. Linn. Soc. Lond. 121 (1946) 121.

-*Meliola millettiae-chrosyphillae* Deighton, Sydowia 7 (1951) 7.

-*Meliola nephelii* Saccardo, Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 42.

-*Meliola newbouldiae* Hansford & Deighton, Mycol. Pap. 23 (1948) 66.

-*Meliola oncinotidis* Doidge, Bothalia 4 (1948) 851.

-*Meliola securidacae* Hansford, Sydowia 10 (1957) 88.

-*Meliola securidacicola* Hansford, The Meliolineae, a monograph, Sydowia Beih. 2 (1961) 82.

-*Meliola stizolobii* Hansford & Deighton, Mycol. Pap. 23 (1948) 31.

-*Meliola tounatae* Stevens, Ann. Mycol. 26 (1948) 204.

Ascospores 28-40 x 11-24 μm . Ascocarp to 190 μm ; Mycelium 8 mm diameter; mycelia setae simple, entire, acute to obtuse, or dentate, scattered or grouped around perithecium, to 960 μm ; capitate hyphopodia opposite or alternate, subanthrose to straight. *Hughesia* phialides sometimes present.

Beeli Formula: 31133223.

Specimens reported: Baker Fungi Malayana 252 (holotype, PBS 4031); also *Baker Fungi Malayana 454* (holotype of *Meliola nephelii*, SING 33781).

Illustrations: Hansford, 1963; Hosagoudar & Agarwal, 2008.

Distribution: Java, Philippines, Singapore.

7.7. *Meliola inocarpi* Stevens, Ann. Mycol. 26 (1928) 232.

Ascospore 43-52 x 17-20 μm . Ascocarp 190 μm diameter. Mycelium 2-8 mm diameter, setae to 900 μm ; capitate hyphopodia opposite to alternate, straight or bent.

Beeli Formula: 31124323

Specimen reported: C.F. Baker Fungi Malayana 459, determined as Meliola sp. Holotype at ILL, and isotype, UC.

Illustration: Hansford, 1963. Distribution: Singapore

7.8. ***Meliola litseae*** Sydow, Ann. Mycol. 15 (1917) 366.

-*Meliola golaensis* Deighton, Sydowia 11 (1958) 105.

-*Meliola litseae* Yates, Philip. Journal Sci. C. Botany 12 (1918) 366.

-*Meliola micheliae* Hansford, Proc. Linn. Soc. London 158 (1947) 34.

-*Meliola singaporensis* Hansford, Proceedings of the Linnean Society, London 157 (1946) 17.

Ascospores 4 septate, 42-60 × 16-25 µm. Ascocarp to 225 µm. Mycelium amphigenous, thin to velvety, 1 to 7 mm diam. Hyphae substraight to undulate or flexuous, capitate hyphopodia alternate, antrorse to ampulliform, mycelia setae scattered or grouped around ascocarp, entire, obtuse or dentate, 600-1000 µm.

Beeli Formula: 31114323

Specimens reported: C.F. Baker Fungi Malayana 457, determined as Meliola sp. C.F. Baker Fungi Malayana 480, type of M. singaporensis (holotype, SING).

Illustrations: Hansford, 1963; Hosagoudar & Agarwal, 2008.

Distribution: Philippines, Singapore, Taiwan.

7.9. ***Meliola mangiferae*** Earle, Bull. New York Bot. Gard. 3 (1905) 307.

-*Meliola helicae* Yamamoto, Trans. Nat. Hist. Soc. Formosa 31 (1941) 54.

-*Meliola naisophyllae* Hansford & Deighton, Mycol. Paper IMI 23 (1948) 13.

-*Meliola palmicola* Winter var *coperniciae* Spegazzini, Anal. Mus. Nac. Buenos Aires 32 (1924) 384.

-*Meliola subdentata* Patouillard, Journal de Bot. (1897) 347.

-*Meliola subdentata* Patouillard var *microspora* Hansford & Deighton, Mycol. Paper IMI 23 (1948) 72.

-*Meliola taiyuensis* Yamamoto, Trans. Nat. Hist. Soc. Formosa 31 (1941) 131.

-*Meliola trichoscyphae* Hansford & Deighton, Sydowia 10 (1957) 94.

Ascospores 4 septate, 40-59 × 12-25 µm. Ascocarp 180-350 µm. Mycelium 3 to 10mm diameter, hyphopodia alternate or opposite, ampulliform to antrorse, mycelia setae scattered or grouped around ascocarp, simple, entire, acute to obtuse or dentate 810 µm. *Hughesia* phialides sometimes present.

Beeli Formula: 31315333

Specimen reported: C.F. Baker *Fungi Malayana* 452, determined as *Meliola mangiferae*. Holotype, NY; SING 33779, annotated as “type”.

Illustrations: Hansford, 1963; Hosagoudar & Agarwal, 2008.

Distribution: Sierra Leone, Australia, Singapore, Taiwan, Philippines, Indonesia, Jamaica, Porto Rico, Venezuela.

7.10. ***Meliola panici*** Earle, Muehlenbergia 1 (1901) 12.

-*Meliola africana* Hansford, Sydowia 10 (1957) 62.

-*Meliola allophylorum* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 29.

-*Meliola alyxiae* Stevens, Bernice P. Bishop Mus. Bull. 19 (1925) 30.

-*Meliola ambigua* Patouillard & Guillard var *caseariaecola* Ciferri, Mycopath. Mycol. Appl. 7 (1954) 93.

-*Meliola aristolochiae* Stevens & Tehon, Mycologia 18 (1926) 4.

-*Meliola banarae* Stevens, Ann. Mycol. 26 (1928) 249.

-*Meliola beilschmiediae* Yomomoto, Trans. Nat. Hist. Soc. Taiwan 31 (1941) 52.

-*Meliola berliniae* Hansford & Deighton, Mycol. Pap. (1948) 23.

-*Meliola camellicola* Yamamoto, Trans. Nat. Hist. Soc. Taiwan 31 (1941) 53.

-*Meliola canarii* Sydow, Ann. Mycol. 12 (1914) 550.

-*Meliola caseariae-arboreae* Hansford var. *guatemalensis* Hansford, Sydowia Beih. 1 (1957) 103.

-*Meliola caseariae-guanensis* Hansford, Sydowia 9 (1955) 11.

-*Meliola castaneifoliae* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 37.

-*Meliola castanha* Theissen, Broteria 12 (1914) 24.

-*Meliola chasaliae* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 38.

-*Meliola cumbrensis* Hansford, Sydowia 10 (1957) 69.

-*Meliola cunoniae* Hansford, Sydowia 9 (1955) 13.

-*Meliola dactylipoda* Sydow, Bothalia 2 (1928) 460.

-*Meliola dasiana* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 41.

-*Meliola daviesii* Hansford var *longiseta* Hosagoudar, Mycopath. Mycol. Appl. 44 (2006) 44.

-*Meliola desmodii-laxiflori* Deighton var *crotalariae* Deighton, Sydowia 11 (1958) 41.

- Meliola eryeibes* Hansford, Reinwardtia 3 (1954) 81.
- Meliola erythrinae* Sydow, Ann. Mycol. 15 (1917) 185.
- Meliola erythrinae* Sydow var. *psophocarp*i Hansford, Sydowia 10 (1957) 70.
- Meliola excoecariae* Doidge, Trans. Roy. Soc. South Africa 8 (1920) 139.
- Meliola fici*um Yates var *ugandensis* Hansford, Sydowia 10 (1957) 72.
- Meliola forsteroniae* (Stevens) Hansford, Proc. Linn. Soc. Lond. 160 (1948) 1920.
- Meliola garryae* Hansford, Sydowia 9 (1955) 17.
- Meliola gnetii* Hansford, Reinwardtia 3 (1954) 85.
- Meliola gregoriana* Stevens, Bernice P. Bishop Mus. Bull. 19 (1925) 39.
- Meliola grewiicola* Hansford, Sydowia 11 (1958) 56.
- Meliola ichnocarp*ii Hansford & Thirumalachar., Farlowia 3 (1948) 295.
- Meliola ichnocarpicola* Hansford, Sydowia Beih. 2 (1961) 559
- Meliola knowltoniae* Doidge, Bothalia 1 (1924) 308.
- Meliola landolphiae-floridae* Hansford, Jour. Linn. Soc. Bot. 51 (1938) 542.
- Meliola landolphii*cola Hansford, Proc. Linn. Soc. Lond. 157 (1945) 23.
- Meliola leptochaeta* Sydow, Ann. Mycol. 15 (1917) 187.
- Meliola lianchangensis* Jiang, Acta Mycol. Sin. 14 (1995) 2.
- Meliola litseae* Graff, Mem. Torrey Bot. Club 17 (1917) 61.
- Meliola litseae* Sydow var. *rotundipodia* Hansford, Reinwardtia 3 (1954) 88.
- Meliola logiseta* Höhnelt, Akad. Wiss. Wien, Sitzungsber. Math.-Naturwiss. Kl. Abt. 1:116 (1907) 100
- Meliola lucumae* Stevens, Illinois Biol. Monogr. 2 (1916) 49.
- Meliola mombasana* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 55.
- Meliola ochrocarpi*i Thite & Patil, Geophytology 13 (1983) 125.
- Meliola pachystellae* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 62
- Meliola palaquii*cola Hansford, Sydowia 11 (1958) 58.
- Meliola pandanii* Sydow, Ann. Mycol. 26 (1928) 89.
- Meliola panici* Earle var. *vetiveriae* Hansford & Deighton in Hansford, Sydowia 10 (1958) 82.
- Meliola pinnatae* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 66.
- Meliola plectroniae* Hansford, Sydowia 9 (1955) 72.
- Meliola pseudocapensis* Hansford, Sydowia 9 (1955) 23.
- Meliola ruiacearum* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1977) 70.
- Meliola sauropicola* Yates, Philipp. Journ. Sci. Bot. 12 (1917) 368.
- Meliola semecarp*ii Sydow, Ann. Mycol. 21 (1923) 95.
- Meliola semecarpicola* Hansford, Sydowia 11 (1958) 58.
- Meliola serjaniae* Stevens, Illinois Biol. Monogr. 2 (1916) 44
- Meliola tabernaemontanae* Spengazzini var *forsteroniae* Stevens, Illinois Biol.

Monogr. 2 (1916) 50.

-*Meliola terecensis* Hansford. Sydowia Beih. 1 (1957) 117.

-*Meliola tijucensis* Hansford. Sydowia 9 (1955) 77.

-*Meliola torricelliae* Kar & Maity. Nytt Mag. Bot. 17 (1970) 81.

-*Meliola trichiliicola* Spegazzini. Anal. Mus. Nac. Buenos Aires 32 (1924) 366.

-*Meliola uncariicola* Deighton. Sydowia 11 (1958) 42.

-*Meliola venezuelana* Orejuela. Mycologia 36 (1944) 437.

-*Meliola vicina* Sydow. Ann. Mycol. 21 (1923) 95.

Ascospores 4-septate. $17-66 \times 11-28 \mu\text{m}$. Ascocarp to $250 \mu\text{m}$ diameter. Colony diameter to 20 mm. thin to dense, velvety; Mycelium with setae, scattered or grouped around ascocarp. simple, acute, to $1000 \mu\text{m}$; capitate hyphopodia alternate to unilateral or opposite, antrorse.

Beeli Formula: 31114223

Specimen reported: C.F. Baker Flora Malayana 456, determined as *Meliola* sp. Listed as *M. panici* by Hansford (1961): 745. Holotype at NY: isotype. UC.

Illustrations: Hansford, 1963; Hosagoudar & Agarwal, 2008.

Distribution: Borneo, Java, Malaya, Philippines, Singapore, Taiwan.

7.11. *Meliola psidii* Fries. Linneae 5 (1830) 549.

-*Amazonia gniomae* Doidge. Bothalia 1 (1924) 204.

-*Meliola aethiops* Saccardo var *cassia* Rao. Mycopath. Mycol. Appl. 33 (1967) 163.

-*Meliola alchorneae* Stevens & Tehon. Mycologia 12 (1926) 21.

-*Meliola allyphyli* Doidge var *pervillei* Mibey & Hawksworth. Mycol. Pap. 174 (1997) 28.

-*Meliola amadelpa* Sydow. Leaft. Philipp. Bot. 9 (1925) 3114.

-*Meliola anodendri* K. Sawada & Yamamoto. Spec. Publ. Coll. Agri. Nat. Taiwan Univ. 8 (1959) 28.

-*Meliola asclepiadacearum* Hansford var *brasiliensis* Hansford. Sydowia 11 (1958) 52.

-*Meliola banarae* Stevens var *aculeatae* Ciferri. Mycopathologia 7 (1954) 99.

-*Meliola bicornis* var *galactiae* Stevens. Ill. Biol. Monogr. 2 (1916) 65.

-*Meliola biparasitica* Ciferri. Ann. Mycol. 36 (1938) 205.

-*Meliola borbonicae* Mibey in Mibey & Hawksworth. Mycol. Pap. 174 (1997) 31.

-*Meliola bridiicola* Hansford. Proc. Linn. Soc. Lond. 157 (1946) 175

- Meliola bryae* Hansford, Sydowia 10 (1957) 65
- Meliola bwaniana* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1997) 33.
- Meliola canthii* Hansford var *leonensis* Hansford & Deighton, Mycol. Pap. 23 (1948) 59.
- Meliola clavulata* Winter var *jamaicensis* Hansford, Sydowia 11 (1957) 54.
- Meliola cnestidis* Doidge, Bothalia 2 (1928) 453.
- Meliola cochlospermifolii* Batista apud Batista, Atlas Inst. Micol. Univ. Recife 1 (1960) 34.
- Meliola corazoyensis* Hansford, Sydowia Beih. 2 (1961) 375.
- Meliola dactylipoda* Sydow var. *jamaicensis* Hansford, Sydowia 10 (1957) 68.
- Meliola daviesii* Hansford, Proc. Linn. Soc. Lond. 157 (1946) 176.
- Meliola dipholidis* Stevens, Ill. Biol. Monogr. 2 (1916) 44.
- Meliola erioglossi* Hansford, Sydowia Beih. 1 (1957) 107.
- Meliola feretiae* Hansford, Sydowia 10 (1957) 71.
- Meliola ferruginiae* Mibey in Mibey & Hawksworth, Mycol. Pap. 174 (1997) 45.
- Meliola funtumiae* Beeli, Bull. Jard. Bot. État. 7 (1920) 95.
- Meliola galactiae* (Stevens) Hansford, Sydowia Beih. (1961) 287.
- Meliola gardneriae* Hansford & Thirumalachar, Farlowia 3 (1948) 293.
- Meliola goianensis* Batista & Maia apud Batista, Atlas Inst. Micol. Univ. Recife 2 (1965) 265.
- Meliola goniomae* Doidge, Bothalia 2 (1928) 461.
- Meliola guareae* Spegazzini, Ann. Mus. Nac. Buenos Aires 23 (1913) 42.
- Meliola hendrickxiana* Hansford, Proc. Linn. Soc. Lond. 159 (1947) 25.
- Meliola henryi* Hosagoudar var *oldenlandiae* Hosagoudar, Biju & Abraham, Nova Hedw. 80 (2005) 486.
- Meliola heyneae* Hansford & Thirumalachar, Farlowia 3 (1948) 294.
- Meliola hippomaneae* Stevens, Ann. Mycol. 28 (1928) 284.
- Meliola horrida* Ellis & Everhart in Smith, Bull. Univ. Iowa 2 (1893) 396.
- Meliola hoyae* Saccardo, Atti Accad. Sci. Ven. 10 (1917) 60.
- Meliola hughesiana* Hansford, Sydowia 10 (1957) 76.
- Meliola hypselodelphidis* Hughes, Myco. Pap. 48 (1952) 51.
- Meliola jasmine* Hansford & Stevens in Hansford, Journ. Linn. Soc. Bot. (1937) 273.
- Meliola lasiacidis* Toro in Chardon & Toro, Monograph Univ. Porto Rico B 2 (1934) 121.
- Meliola lictorea* Ciferri, Ann. Mycol. 36 (1938) 214.
- Meliola lobellicola* Farr, Canad. J. Bot. 47 (1969) 372.
- Meliola longispora* (Gaillard) Stevens, Ann. Mycol. 26 (1928) 244.
- Meliola malacotricha* Spegazzini var. *longispora* Gaillard, Le Genre *Meliola* (1892) 82.

- Meliola microthea* Sydow, Ann. Mycol. 37 (1939) 331.
- Meliola mitragynicola* Deighton var *leonensis* (Hansford & Deighton) Deighton, Sydowia 11 (1958) 111.
- Meliola mitragynicola* Deighton, Sydowia 11 (1958) 110.
- Meliola ocoteicola* Stevens, Ill. Biol. Monogr. 2 (1916) 45.
- Meliola oldenlandiae* Hansford & Stevens var *indica* Hosagoudar, Biju & Abraham, Nova Hedw. 80 (2005) 492.
- Meliola oligopoda* Sydow, Ann. Mycol. 21 (1923) 89.
- Meliola opuntiae* Hansford, Sydowia 10 (1957) 81.
- Meliola ormocarpi* Hansford & Deighton, Mycol. Pap. 23 (1948) 30.
- Meliola osmanthi* Sydow var. *hawaiiensis* Hansford, Sydowia 9 (1955) 44.
- Meliola panici* Earle var *lasiacidis* (Toro) Hansford, Sydowia Beih. (1961) 747.
- Meliola panici* Earle var. *olyrae* Hansford, Sydowia 10 (1957) 82.
- Meliola parenchymatica* Gaillard, Le Genre *Meliola* (1892) 180
- Meliola pentaphylacis* Song & Hu in Song & Hugh, Journ. Trop. Subtrop. Bot. 5 (1997) 37.
- Meliola petrospermicola* Stevens & Roldan, Philipp. Journ. Sci. 56 (1935) 69.
- Meliola phoebes* Hansford, Proc. Linn. Soc. London 160 (1948) 136.
- Meliola physostigmatis* Hansford & Deighton, Mycol. Pap. 23 (1948) 33.
- Meliola psychotriae* Hansford, Sydowia Beih. 2 (1961) 375.
- Meliola psychotriae* Earle var *moreliae* Hansford & Deighton, Sydowia Beih. 2 (1961) 597.
- Meliola randiae-aculeate* Hansford, Sydowia 9 (1955) 74.
- Meliola ranganathii* Hansford, Proc. Linn. Soc. London 157 (1946) 185.
- Meliola samydae* Ciferri, Ann. Mycol. 29 (1931) 285.
- Meliola saurauiae* Sydow, Ann. Mycol. 37 (1939) 232.
- Meliola scabriseta* Hansford & Deighton var. *brasiliensis* Hansford, Sydowia 9 (1955) 47.
- Meliola scaevolae* Sydow, Ann. Mycol. 12 (1914) 551.
- Meliola secamonis* Hansford, Proc. Linn. Soc. Lond. 156 (1944) 39.
- Meliola silventvalleyensis* Hosagoudar, Journ. Mycopath. Mycol. Appl. Research 45 (2006) 3.
- Meliola straussiae* Hansford, Sydowia Beih. 1 (1957) 117.
- Meliola strophanthi* Hansford non Doidge, Journ. Linn. Soc. Bot. 51 (1937) 282
- Meliola strophanthicola* Hansford, Sydowia Beih. 61 (1961) 551.
- Meliola taitensis* Mabey & Cannon, Crypto. Mycol. 20 (1999) 277.
- Meliola thungergiicola* Hansford & Deighton, Mycol. Pap. 23 (1948) 68.
- Meliola trichostroma* (Kunze) Toro, Journ. Depart. Agric. Univ. Porto Rico 36 (1952) 62.

-*Meliola yuanjiangensis* Jiang, Acta Mycol. Sinica 8 (1989) 177.

-*Meliola zamboangensis* Hansford, Sydowia Beih. 1 (1957) 119.

-*Sphaeria trichostroma* Kunze in Weigelt's Exsiccatum (1827). (see Pfister, Mycotaxon 23: (1985) 1-139.

Ascospores $33-48 \times 11-21 \mu\text{m}$. Ascocarp $140-200 \mu\text{m}$ diameter. Mycelium to 15 mm; mycelial setae scattered or grouped around ascocarp, simple, sometimes dentate, $270-600 \mu\text{m}$; capitate hyphodia alternate.

Beeli Formula: 31114222

Specimen reported: A specimen of *A. Clupp* 5948 (SING 38558) at K is cited by Hansford (1961) from Singapore. Holotype at S.

Illustrations: Hansford, 1963; Housgoudar & Agarwal, 2008.

Distribution: Borneo, Burma, Malaya, Philippines, Singapore, Taiwan.

7.12. *Meliola* sp.

Specimen reported: C.F. Baker Fungi Malayana 458. UC, BPI 692188-89.

Distribution: Singapore

Note: The Baker collection is not a *Meliola*; the material appears to be sterile.

8. *Meliolina* H. Sydow & P. Sydow, Ann. Mycol. 12 (1914) 553.

Ascospores 3-septate, constricted, darkly pigmented, often with thin-walled pale bands. Ascus extenditunicate, paraphyses evanescent. Ascocarp superficial on external mycelium, globose, glabrous, astomatic, often setose. Mycelium brown, superficial, exhyphopodiate, forming stomopodia, setose, furcated.

8.1. *Meliolina malacensis* (Saccardo) Trotter in Saccardo, Sylloge Fungorum 24 (1926) 360.

-*Meliola malacensis* Saccardo, Bull. Orto Bot. Regia Univ. Napoli 6 (1918) 43. Ascospores with midconstriction, $35-45 \times 12-15 \mu\text{m}$. Ascus oblong-clavate, $80-90 \mu\text{m}$. Ascocarp $250-300 \mu\text{m}$; setae simple, acute, $300-350 \times 5-5.5 \mu\text{m}$. The associated mitosporic state, *Briania* (Reynolds, 1989), was not found.

Specimen reported: C.F. Baker Fungi Malayana 451, determined as *Meliola malacensis* Saccardo.

Distribution: Singapore

Note: This taxon was recognized by Hansford (1961) as a *Meliolina* and excluded from *Meliola*. This species was not accepted in the treatment of *Meliolina* by Hughes (1993). *Meliola* and *Meliolina* are morphologically different as well as distant in phylogeny. These two members of the Pezizomycotina were phylogenetically inferred by Saenz and Taylor (1999) to be on separate clades. *Meliola* is a taxon in the Sordariomycetes, Meliomycetidae, Meliolales with a unitunicate ascus, as predicted by Luttrell (1989), and *Meliolina* is in the Dothidiomycetes, Dothidomycetidae, with an extenditunicate modification of the fissitunicate ascus (Reynolds, 1989a).

8.2. *Meliolina cladotricha* (Léveillé) H. Sydow & P. Sydow, Ann. Mycol. 17 (1914) 553h.

-*Meliola octospora* Cooke, Grevillea 11 (1882) 71.

-*Meliolina octospora* (Cooke) Höhnelt, Akad. Wiss. Wien. Sitzungsber., Math.-Naturwiss. Kl. Abt. 118 (1909) 813.

-*Meliolina octospora* Höhnelt, Akad. Wiss. Wien Sitzungsber. Math.-Naturwiss. Kl. Abt 1. 128 (1919) 557.

Ascospores with hyaline band in terminal cells near septum, $45\text{--}57 \times 17\text{--}20\text{ }\mu\text{m}$. Ascus with abundant paraphyses, $100\text{--}120\text{ }\mu\text{m}$. Ascocarp spherical, $400\text{ }\mu\text{m}$ diameter, setae $145\text{--}186\text{ }\mu\text{m}$.

Specimen reported: A Flora of Singapore collection (SING 96897) made by an unknown collector in 1899 was labeled as *Meliola octospora* Cooke. There are no spores.

Note: Hughes (1993) argues for the acceptance of *M. octospora* Höhnelt based on his interpretation of Höhnelt's (1909, 1919) observations and supposed prior misuse by Stevens (1927), Hansford (1954), Yamamoto (1957) and Sivanesan (1984). We find Hughes' argument to be suspicious in that the attempt to affirm the observations of von Höhnelt was based on his inadequate material now curated in Herbarium FH and assumptions made from the observations of Yamamoto (1957) from Taiwan, but without surviving specimens.

9. *Micropeltella* Montagne, Ann. Sci. Nat. Bot., sér 2, 17 (1842) 325.

Ascospores hyaline, 2-8 septate, clavate. Asci clavate, cylindrical, fissitunicate, paraphysate. Ascocarp orbicular, dimidiate-scutulate, margin pelluculoae, blue to green-black, textura meandriforme, plechymatous; ostiole distinct, round. Mycelium absent at ascocarp maturity.

Batista (1959) noted that the species of this taxon were removed from *Micropeltis* because of a lack of paraphyses, based on the examination of Singapore specimens cited here. The type specimen is Montagne 1134, Herb. P.

9.1 *Micropeltella marginata* (Montagne) Batista, Inst. Micol. Univ. Recife Publicação 56 (1959) 160.

-*Micropeltella albo-marginata* (Spegazzini) Batista, Inst. Micol. Univ. Recife Publicação 56 (1959) 153; -*Micropeltis albo-marginata* Spegazzini, Bol. Acad. Nac. Ci. Argent. 11 (1889) 572.

-*Micropeltella orchidearum* (P. Hennings) Batista, Inst. Micol. Univ. Recife Publicação 56 (1959) 163.

-*Micropeltis albo-ostiolata* P. Hennings, Hedwigia 47 (1908) 268.

-*Micropeltis ekmanii* Petrak & Ciferri, Ann. Mycol. 30 (1930) 205.

-*Micropeltis marginata* Montagne, Ann. Sci. Nat. (Paris) 4, 3 (1855) 133.

-*Micropeltis orchidearum* P. Hennings In: A. Engler & K. Prantl, Die natürlichen Pflanzenfamilien 23 (1897) 286.

Ascospore 87-125 × 12-15 µm. Ascus fissitunicate. Ascocarp dimidiate, plectenchymatic, blue-black, ostiolate, orbicular, 535-700 µm diameter.

Specimens reported: C.F. Baker *Fungi Malayana* 460; see also SING 36128, 36129. C.F. Baker

Malayana #460 is determined as *Micropeltis marginata* Montagne

Illustration: Batista, 1959: 88, Fig. 18.

Distribution: Singapore.

10. *Micropeltis* Montagne Ann. Sci. Nat. Bot. sér 2, 17 (1842) 122.

Ascus paraphysate, fissitunicate. Ascospores hyaline, 2-many septate, clavate, oblong to cylindrical. Ascocarp dimidiate-scutate, parenchymatic, circular, ostiolate, green-black. Mycelium absent.

10.1. *Micropeltis trimera* Saccardo, Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 51.

Ascospores fusoid, 2-3 septate, 35 × 8 µm. Ascocarp margin pelliculose, black, 510-610 µm diameter.

Specimen reported: C.F. Baker *Fungi Malayana* 461, holotype in BP and isotype, UC. The UC specimen has an ascocarp measuring 350-421 µm in diameter; the immature asci measured 100 µm in length; the ascospores are immature.

Illustration: Batista 1959: 146. Fig. 60.

Distribution: Singapore.

11. ***Polychaeton*** (Persoon) Lévillé

-*Fumago* [subgenus] *Polychaeton* Persoon. *Mycologica europea*. Sectio prima. Erlangae (1822)

-*Morfea* Roze Bull. Soc. Bot. France 14: (1868) 15.

-*Morfea* (G. Arnaud) Ciferri & Batista (1963) 140.

-Subgenus *Morfea* G. Arnaud (1913) 280.

Lectotype: *Polychaeton quercinum* (Persoon) O. Kuntze (1891) = *Fumago quercina* Persoon, *Mycologica europea*. Sectio prima. Erlangae (1822). Type: Herb. L.

Mitospores formed in an expanded basal or midway centrum within a wide stalk. Stalk single, or branched with a columnate extension with a fringed ostiole. Mitospores unicellular, hyaline.

11.1. ***Polychaeton artocarp*** (Batista, Nascimento & Ciferri) Khodap. Rostaniha 7 (2006) 79.

-*Microxiphium artocarp* Batista, Nascimento & Ciferri in Batista & Ciferri. Quaderno 31 (1963) 114.

-*Microxiphium footi* (Berkeley & Desmazières) Spegazzini 1918.

-*Microxiphium jafarnizamie* Manocharachar (1979) Nova Hedwigia 63:185.

-*Microxiphium jambosae* Batista apud Batista & Ciferri. Quaderno 31 (1963) 132.

-*Microxiphium leptospermi* Fisher. Proc. Royal Soc. Victoria. N.S.W. 45 (1963) 191.

-*Microxiphium obtusulum* Saccardo Phil. J. Sci. (1921) 19: 602.

-*Microxiphium secundum* Batista & Ciferri, Quaderno 31 (1963) 136.

Mitospores measuring $2 \times 5 \mu\text{m}$.

Note: Lim (1975) listed three Singapore collections of *Microxiphium artocarp*, *M. leptospermi*, and *M. secundum*.

11.2. ***Polychaeton brasiliense*** (Batista in Batista & Ciferri), *comb. nov.*

Basionym: *Microxiphium brasiliense* Batista in Batista & Ciferri. Quaderno 31 (1963) 119.

-*Microxiphium alanqii* Agarwal & Sharma, J. Indian Bot. Soc. 53(1-2) (1974) 77.

-*Microxiphium ciliolatum* (Saccardo) Ciferri & Batista apud Batista &

Ciferri, Quaderno 31 (1963) 121.

-*Microxiphium coffeanum* Batista & Matta, Quaderno 31 (1963) 122.

-*Microxiphium inspersum* Batista & Ciferri, Quaderno 31 (1963) 132.

-*Microxiphium spathodeae* Batista & Matta apud Batista & Ciferri, Quaderno 31 (1963) 137.

-*Microxiphium unedonis* (Marie & Saccardo) Batista & Ciferri, Quaderno 31 (1963) 139.

-*Polychaeton bassiae* Manocharachary, Kunwar, Sarath & Nagamani in Manocharachary, Kunwar, Babu & Nagamani. 2003.

Mitospores measuring $2 \times 3.5 \mu\text{m}$.

Note: Lim (1975) listed two Singapore collections of *Microxiphium coffeanum* and *M. spathodeae*.

11.3. *Polychaeton tenellum* (Saccardo), *comb. nov.*

Basionym: *Microxiphium tenellum* Saccardo, Bull. dell'orto Bot. della R. Univ. Napoli 24 (1918) 5.

-*Microxiphium aciculiforme* Ciferri, Batista & Nascimento in Batista & Ciferri, Quaderno 31 (1963) 110.

-*Microxiphium atmosphaericum* Batista, Bezerra & Garnier in Batista & Ciferri, Quaderno 31 (1963) 117.

-*Microxiphium columnatum* Batista, Ciferri & Nascimento in Batista & Ciferri, Quaderno 31 (1963) 123.

-*Microxiphium cylindricum* Batista & Ciferri, Quaderno 31 (1963) 127.

-*Microxiphium dubium* Saccardo, Ann. Mycol. 13 (1915) 127.

-*Microxiphium philippinensis* Ciferri & Batista in Batista & Ciferri, Quaderno 31 (1963) 135.

-*Microxiphium viride* Batista & Ciferri, Quaderno 31 (1963) 141.

-*Polychaeton pinicola* Batista, Nascimento & Ciferri apud Batista & Ciferri, Quaderno 31 (1963) 135.

-*Polychaeton purpuraefaciens* (J.F.H. Beyma) Reynolds & Gilbert, Aust. Syst. Bot. 18(3) (2005) 275.

Mitospores measuring $1.5 \times 5 \mu\text{m}$.

Specimens reported: C.F. Baker Fungi Malayana 468, holotype at BP; isotype, UC; Singapore, Bukit Timah Reserve, Oct 2007, DRR Singapore 20 (SING, UC). Lim (1975) also listed two Singapore collections of this species as *Microxiphium aciculiforme*, *M. columnatum*.

Illustrations: Beyma, 1931; Batista & Ciferri, 1963; Ciferri *et al.*, 1956.

Distribution: Indonesia, Philippines, Singapore, Taiwan, Thailand, Vietnam.

Note: Forty six species have been described as *Microxiphium* (= *Microxyphium*) (Harvey) ex Berkeley & Desmazières in Thümen (1879). Most of these are synonyms of *Polychaeton*.

Yamamoto (1955) noted a “*Microxyphium* (*Ceratopycnidium*) type” in the “imperfect stage,” described as, “A peridium is semispherical...” Reynolds and Gilbert (2005) found that *Microxiphium* is based on two mitosporic forms. The mycelium forms a setose pellicle and mitosporic reproduction is twofold: 1. a rosette of hialidic cells found in the mycelium or as a cortex of hyphae surrounding the mycelia setae (*Microxiphium*); 2. subpellicular areas producing triradiate, septate mitospores (*Bisbyopeltis phoebesii*).”

The pycnidium of *Microxiphium sensu* Batista & Ciferri (1963b) is the source of a few characters that are used to distinguish 28 taxa. It is described as cylindric. A fimbriated appearance is given to the apex by hyaline hyphal extensions beyond the darkly pigmented cells forming the apical dispersal column. The taxa recognized range in a continuous progression from an attenuated form to one with a somewhat attenuated lower area that continues as an extended neck formed around a canal through which the mitospores are dispersed from the basal conidiogenous centrum. A continuum of character variability can be found in an examination of the types and other collections of *Microxiphium* spp. in Herbarium URM and in pure culture isolates derived from a single mitospore (unpublished research).

Polychaeton forms a mitosporic centrum within a wide stalk, located from the central to the upper part. *Conidioxyphium* Batista and Ciferri was found to be indistinguishable microscopically (Singh *et al.*, 2006) with cluster analysis, principal components analysis, and discriminate analysis (Faull *et al.*, 2002). Arnaud (1913) considered these structures to be spermagonia. Beyma (1931) gives details of development in culture. The conidiogenous hyphae of the centrum are sympodially branched, forming phialides with collarettes. The stalks may be single or branched; the branching often arises from mitospores germinating directly on the stalk. A columnate extension beyond the centrum often has a fringed ostiole. The mitospores are unicellular and hyaline. Observations (Reynolds, 1978) made on the mitosporic structures of *Scorias spongiosa* and collections from tropical climates indicate that the pycnidia of *Polychaeton* are variable in length and branching patterns. The fruit body stalk that subtends the mitosporic centrum is characteristically as wide as the centrum. The mitospore morphology is stable and produced within an internal pycnidial centrum. The hyaline, unicellular spore is exuded from the centrum along a canal

in a columnate neck. A droplet of water soluble matrix contain multiple conidia forms under humid conditions. The mitospores flow down the fruit body onto a substrate; dilution of the spore containing drop initiates germination. Typically the mitospore divides to form a hyphal initial and the melanoid pigmentation accumulates in the cell walls. Measurements of the mitospores as they are exuded from the apex of the fruit body comprise primary taxonomic characters.

The name *Morfea* has been utilized for both a concept of mitosporic and ascosporic monomorphic and pleomorphic species by Roze (1868) and Batista and Ciferri, (1963a). The name was clarified as a mitosporic nomen and affirmed as *Polychaeton* (Hughes, 1976; Punithalingam, 1981; Reynolds, 1998).

12. ***Schizothyrium*** Desmazières, Ann. Sci. Nat. Bot. sér 3, Bot. 11 (1840) 360.

Ascospores 1-septate, hyaline; Ascus extenditunicate; ascocarp dimidiate, dark, with radial margin; Mycelium inconspicuous.

12.1. ***Schizothyrium longispora*** (Patouillard) Arx, in Müller & Arx, Die Gattungen der didymosporen Pyrenomycetes (1962) 202.

-*Dictyopeltis lucumae* Batista, Anais IV. Congresso Nac. Soc. Bot. Brazil (1953) 117.

-*Eremotheca philippensis* Sydow, Ann. Mycol. 15 (1917) 235,

-*Microthyriella enaequalis* Batista, Mycopath. Mycol. Appl. 5 (1951) 171.

-*Microthyriella guianensis* Stevens & Manter, Bot. Gaz. 79 (1925) 290.

-*Microthyriella macrospora* Höhnelt, Akad. Wiss. Wien, Sitzungsber. Math.-Naturwiss. Kl. Abt. I, Biologie 127 (1918) 630.

-*Microthyrium browneanum* Saccardo, Bull. Orto Bot. Regis Univ. Napoli 6 (1918) 50.

-*Microthyrium longisporum* Patouillard, Bull. Soc. Mycol. France 20 (1888) 118.

Ascospores 35-60 × 12-17 µm. Asci 60-75 × 40-50 µm. Ascocarp superficial, roundish, 400-1200 µm diameter, dark brown.

Specimen reported: C.F. Baker Fungi Malayana 465. Holotype at UC.

Distribution: Singapore.

13. ***Setameliola***, gen. nov

=*Meliola sensu* Mibey & Hawksworth (1997)

Sporidia 3-4, septata, fusca. Asci con 2-4 spori, aparthysati. Ascocarp in

mycelio maculiformi superficiali, globosa, astoma, setosus. Mycelium ex hyphis brunneis, septatis vel hyphis formans catillus, cum hyphopodia, setosus.
 - Typus species: *Setameliola argentina* (Spegazzini) D.R.Reynolds

Diagnosis: This taxon is distinguished by the presence of setae on the perithecium as well as the mycelium. *Meliola* Fries emended Bornet (1851) *sensu* Hansford (1961) includes species that have glabrous as well as setose ascocarp. The Mibey and Hawksworth (1997) *Meliola* emendment provides for a perithecium “devoid of setae or appendages.” Accordingly, *Setameliola* includes the 23 species of *Meliola sensu lato* with setose ascocarp. The mycelial setum is the character distinction of *Meliola* and *Setameliola* from *Irenopsis* (setose ascocarp), *Appendiculella* (laviform ascocarp appendages) and *Asteridiella* (glabrous ascocarp). Two of the 24 species of *Setameliola* (*S. araucariae* and *S. agathidis*) form unusual thalloid plates (Ellis, 1974; Hansford, 1961; Katumoto & Hosagoudar, 1989).

13.1 *Setameliola argentina* (Spegazzini), *comb. nov.*

Basionym: *Meliola argentina* Spegazzini, Ann. Soc. Cient. Argentina 9 (1880) 177. [Holotype: *Spegazzini 510*, S].

-*Irenopsis martiniana* (Gaillard) Stevens, Ann. Mycol. 25 (1927) 437

-*Meliola argentina* Spegazzini var *hawaiiensis* Hansford, Sydowia 11 (1958) 51.

-*Meliola argentina* Spegazzini var *africana* Hansford, Sydowia 9 (1955) 9.

-*Meliola argentina* Spegazzini var *leenwenii* Hansford, Sydowia 10 (1957) 63. Type: BO 5607.

-*Meliola circinans* Earle, Bull. New York Bot. Gard. 3 (1905) 304.

-*Meliola circinans* Earle var *rhynchosporae* Hansford (1904) 304.

-*Meliola intricata* Sydow, Philipp. Journ. Sci. Bot. (1913) 268. Type: PBS 7152

-*Meliola juddiana* Stevens, Bernice B. Bishop Mus. Bull. 19 (1925) 32.

-*Meliola martiniana* Gaillard, Le Genre *Meliola* (1892) 68.

-*Meliola setulifera* (Spegazzini) Stevens, Ann. Mycol. 25 (1927) 285. Type: Rabenhorst and Winter, *Fungi Europaei et Extraeuropaei* 3852 (Herb. F).

Ascospores oblong, obtuse, 4-septate, 37-47 x 15-18 µm. Ascocarp to 190 µm diameter, with setae straight to acute, 90 x 8 µm. Mycelium epiphyllous, dense, velvety; hyphae sub-straight to undulate, branching opposite; capitate hyphopodia alternate to opposite, head cell straight or bent, stalk cell cuneate; mycelial setae, simple with acute apex, entire, 400 µm length.

Illustrations: Hansford, 1963; Stevens, 1928: 381, Plate IV-40.

Distribution: Borneo, Philippines, Singapore, Taiwan

The following recombinations are made on the basis of the setose ascocarp:

13.2. *Setameliola agathidis* (Ellis), *comb. nov.*

Basionym: *Meliola agathidis* Ellis, Trans. Brit. Mycol. Soc. 63 (1974) 96. Type: IMI 73853.

13.3. *Setameliola apiculata* (Hansford), *comb. nov.*

Basionym: *Meliola apiculata* Hansford, Proc. Linn. Soc. London 160 (1948) 137. Type: Herb. ILL.

13.4. *Setameliola arancariae* (Ellis), *comb. nov.*

Basionym: *Meliola araucariae* Ellis, Trans. Brit. Mycol. Soc. (1974) 93. Type: IMI 170578.

13.5. *Setameliola artocarpiicola* (Stevens ex Hansford), *comb. nov.*

Basionym: *Meliola artocarpiicola* Stevens ex Hansford, Sydowia Beih. 11 (1958) 52. Type: PBS 36433.

13.6. *Setameliola bayamonensis* Tehon var *guettardae* (Ciferri), *comb. nov.*

Basionym: *Meliola bayamonensis* Tehon var *guettardae* Ciferri, Mycopath. Mycol. Appl. 7(1954) 98. Type: Herb. S.

13.7. *Setameliola brinkii* (Hansford), *comb. nov.*

Basionym: *Meliola brinkii* Hansford, Reinwardtia 3 (1954) 96. Type: BO 12315.

13.8. *Setameliola canariicola* (Stevens ex Hansford), *comb. nov.*

Basionym: *Meliola canariicola* Stevens ex Hansford, Sydowia Beih. 1 (1957) 102. Type: PBS 34009.

13.9. *Setameliola canthii* Hansford var *aristata* (Hansford), *comb. nov.*

Basionym: *Meliola canthii* Hansford var *aristata* Hansford, Proc. Linn. Soc. Lond. 51 (1945) 22. Type: Herb. IMI.

-*Meliola woodiana* Saccardo var *aristata* Hansford, Journ. Linn. Soc. Bot. 51 (1937) 284.

13.10. *Setameliola circinans* (Earle), *comb. nov.*

Basionym: *Meliola circinans* Earle, Bull. New York Bot. Gard. 3 (1905) 304. Type: Heller 6347, NY.

13.11. *Setameliola circinans* Earle var *rhynchosporeae* (Hansford) *comb. nov.*

Basionym: *Meliola circinans* Earle var *rhynchosporeae* Hansford, Sydowia 9

(1955) 13. Type: *Nash 1803*, FLS.

13.12. ***Setmeliola coriae*** (Hueguenin), *comb. nov.*

Basionym: *Meliola coriae* Hueguenin, Rev. Mycol. (Paris) 34 (1969) 30. Type: Herb. P.

13.13. ***Setmeliola cyperi*** (Patouillard in Gaillard), *comb. nov.*

Basionym: *Meliola cyperi* Patouillard in Gaillard, Le Genre *Meliola* (1892) 70. Type: Herb. FH.

13.14. ***Setmeliola fusispora*** (Yamamoto), *comb. nov.*

Basionym: *Meliola fusispora* Yamamoto, Trans. Nat. Hist. Mus. Taiwan 31 (1941) 219. Type: Herb. TNS.

13.15. ***Setmeliola kaduae*** (Stevens), *comb. nov.*

Basionym: *Meliola kaduae* Stevens, Bernice B. Bishop Mus. Bull. 19 (1925) 30. Type: Herb. ILL.

13.16. ***Setmeliola martiniana*** (Gaillard), *comb. nov.*

Basionym: *Meliola martiniana* Gaillard, Le Genre *Meliola* (1892) 68. Type: *Rabenhorst's Fungi Europea* 3852 (Herb. F).

-*Irenopsis martiniana* (Gaillard) Stevens, Ann. Mycol. 25 (1927) 437.

-*Meliola perseae* Stevens forma *setulifera* Spegazzini, Bol. Acad. Nac. Cien. Cordoba 26 (1923) 380.

-*Meliola setulifera* Stevens, Ann. Mycol. 26 (1928) 285.

13.17. ***Setmeliola microtricha*** (Sydow in Sydow & Sydow), *comb. nov.*

Basionym: *Meliola microtricha* Sydow in Sydow & Sydow, Ann. Mycol. 18 (1920) 157. Type: Herb. UC.

The Singapore record for this taxon is *C.F. Baker Fungi Malayana* 490 determined as *Tetrachia singularis* Saccardo (1918). The taxon is cited by Hansford (1961) as the type under *Meliola microtricha* H. Sydow & P. Sydow [see *Annales Mycologia* 18 (1920) 157]. The Saccardo description is of a sporodochial fungus and only conidia are described. Sydow & Sydow (1920) regarded *Tetrachia singularis* as a synonym of *Spegazzinia meliolae* Zimmerman. Damon (1953) considered that *Spegazzinia tessartha* (B & C) Saccardo comprised a monotypic genus and cited *T. singularis* as a synonym of *Isthmospora trichophila* (Atkinson) Damon. Hughes (1953) considered *T. singularis* to be a synonym of *Trichothrium*.

The UC specimens 490 and 491 (determined as *T. singularis*, *n. gen. et n. sp.*) from the *C.F. Baker Fungi Malayana exsiccatum* exhibit

two epifoliar fungi. The isthmospores of *T. singularis* or *T. asterophorum sensu* Hughes (1953) similar to those of *Spegazzinia*, are found in both specimens. *Tetrachia singularis* is a hyperparasite of a second fungus present that agrees with the Hansford (1961) description of *Setameliola* (= *Meliola*) *microtricha*. No thyrlothechia of *T. singularis* were seen.

13.18. ***Setameliola paratrophidis*** (Hansford), *comb. nov.*

Basionym: *Meliola paratrophidis* Hansford, Reinwardtia 3 (1954) 96. Type: Herb. BO.

13.19. ***Setameliola pradosiae*** (Batista in Batista, Nascimento & Maia), *comb. nov.*

Basionym: *Meliola pradosiae* Batista in Batista, Nascimento & Maia, Inst. Micol. Publicação 25 (1956) 8. Type: Herb. URM.

13.20. ***Setameliola pseudomori*** (Hansford), *comb. nov.*

Basionym: *Meliola pseudomori* Hansford, Proc. Linn. Soc. New South Wales (1954) 65. Type: Herb. IMI.

13.21. ***Setameliola sakahensis*** (Yamamoto), *comb. nov.*

Basionym: *Meliola sakahensis* Yamamoto, Trans. Nat. Hist. Soc. Taiwan 30 (1940) 421. Type: Herb. BPI.

14. ***Trichomerium*** Spegazzini emend. Reynolds, Mycotaxon 14 (1982) 190.

-*Capnobatista* Ciferri & Leal in Batista, A.C. & R. Ciferri, Saccardo 2 (1963) 75.

-*Chaetopotius* Batista, Mycopath. Mycol. Mycol. Appl. 5 (1951) 151. *Pro parte*

-*Triposporiopsis* Yamamoto, Special Publ. Kasai Shuppan Institute Minato-ku Tokyo (1955) 55.

Ascospores hyaline, fusiform, 18-32 x 5-10 µm. Hymenium periphysate. Asci fissitunicate, obclavate.

Ascocarp dark brown, setose, ostiolate 80-230 µm. Mycelium of superficial, branching, septate hyphae, not setose nor hyphopodiate

14.1 ***Trichomerium grandisporum*** (Ellis & Martin in Ellis & Everhart) Batista & Ciferri, Saccardo 2 (1963) 210 (see Reynolds, 1982, for synonyms).

Ascospores hyaline, fusoid, granulate, 4-6 septate, 18-38 x 5-10 µm. Asci aparaphysate, fissitunicate. Ascocarp ostiolate, 100-170 x 88-170 µm; Setae 62.5-170 µm in length. Mycelium of superficial, branching, septate hyphae, brown to blackish, not setose nor hyphopodiate.

Specimens reported: Singapore, Bukit Timah Reserve. Oct 2007. *DRR I*, 5, 6, 14, 20, 22. (SING, UC).

Illustration: Batista & Ciferri 1963a: figs 75-96.

Distribution: Pantropical

Note: A specimen identified by F. von Höhnelt as *Aithaloderma setosum* is represented by a microscope slide preparation (IMI 63263, F). The sparse data indicate that the collections were made in Singapore in 1956. An unclear understanding of *Aithaloderma* species is manifested by different interpretations of the ascocarp. In one type, the setose ascocarp is globose similar to that of *Trichomerium*. Other species have been attributed with a shield over the ascocarp that is characteristic of *Chaetothyrium*. We find that the *Aithaloderma* examined by von Höhnelt should be assigned to *Trichomerium grandisporum*.

Acknowledgements

I thank the Singapore Botanical Garden for a Research Fellowship in October of 2007; Dr. M.M. Thang, Dr. D. Pfister and Dr. Paul Kirk made helpful suggestions.

References

- Alexopoulos, J.C., C.W. Mims and M. Blackwell. 1996. *Introductory Mycology*, 4th Ed. Wiley, New York.
- Arnaud, G. 1913. Contribution a l'étude des fumagines. 3^{me} Partie. *Annales Ecole Nationale d'agriculture, Montpellier, sér. 2*, **12**: 23-54.
- Arx, J.A. von and E. Müller. 1975. A re-evaluation of the bitunicate ascomycetes with keys to families and genera. *Studies in Mycology* **9**: 1-459.
- Batista, A.C. 1959. Monografia dos fungos Micropeltaceae. *Instituto de Micologia, Universidad do Recife. Publicacao* **66**: 1-519.
- Batista, A.C. and R. Ciferri. 1963a. Capnodiales. *Saccardoia* **2**: 1-298.

- Batista, A.C. and R. Ciferri. 1963b. The sooty molds of the family Asbolisiaceae [IMUR Publication 163]. *Quaderno* **31**: 1-229.
- Beeli, M. 1920. Note sur le Genre *Meliola*. *Bulletin Jardin Botanique l'état, Bruxelles* **7**: 89-160.
- Beyma, Thoe Kingma F.H. van. 1931. Untersuchungen über Rußtau. *Verhandelingen der konenkljke nederlandsche akademie van wetenschappen; afdeeling natuurrkunde; tweede sectie* **29**: 3-29, 4 plates.
- Bornet, E. 1851. L'Organisation des Especies qui composent le Genre *Meliola*. *Annales Sciencias Naturelles Botanique Séries* **3, 16**: 1-257.
- Ciferri, R. 1954. *Meliolae* of Santo Domingo. *Mycopathologia et Mycologia Applicata* **7**: 81-211.
- Ciferri, R., A. C. Batista and M.L. Nascimento. 1956. Two new genera of pycnidiaceous sooty molds associated with *Microxyphium* and *Septonema*. *Institute of Mycology, Recife, Pernambuco, Brasil Publication* **47**: 1-7, 4 figures.
- Damon, S.C. 1953. Notes on the hyphomycetous genera *Spegazzinia*, Sacc. and *Isthmospora* Stevens. *Bulletin of the Torrey Botanical Club* **80(3)**: 155-165.
- Dennis, R.W.G. 1968. *British Ascomycetes*. J.Cramer, Stuttgart.
- Dennis, R.W.G. 1970. *Fungus flora of Venezuela and adjacent countries*, Her Majesty Stationery Office, Kew, Surrey, Great Britain.
- Dilcher, D.L. 1965. Epiphyllous fungi from Eocene deposits in Western Tennessee. *Palaeontographica B*, **116**: 1-54.
- Ellis, J.P. 1974. Some thalloid *Meliolas*. *Transactions of the British Mycolgical Society* **63**: 93- 98, 2 plates.
- Farr, M.L. 1971. A modified 'Beeli formula' as identification tool for asterinaceous fungi and their pycnidial stages. *Mycopathologia* **43**: 161-163.

- Faull, J.L., I. olejnik, M. Ingrouille and D. Reynolds. 2002. A reassessment of the taxonomy of some tropical sooty moulds, pp. 33-40. In: R. Watling, J.C. Franklin, A.M. Ainsworth, S. Ismal and C.H. Robinson (eds). *Tropical Mycology 2: Micromycetes*. CABI Publications, Wallingford, Great Britain.
- Fries, E.M. 1825. *Systema Orbis Vegetabilis*, vol. 1. Lund. 374 pp.
- Gilbert, G., D.R. Reynolds, and A. Bethancourt. 2007. Host range, host abundance, environment, and the patchiness of epifoliar fungi symbionts in two tropical rain forests. *Ecology* **88**: 575-582.
- Hansford, C.G. 1954. Australian Fungi. II. New records and revisions. *Proceedings of the Linnean Society of New South Wales* **158**: 97-141.
- Hansford, C.G. 1961. The Meliolineae, a monograph. *Sydowia Beihefte* **2**: 1-806. Hansford, C.G. 1963. Iconographia Meliolarum. *Sydowia Beihefte* **5**: 284 plates, 1812 figures.
- Höhnelt, F. von. 1909. Fragmente zur Mykologie. IX. Mitteilung. Nr. 407-467. In: Sitzungsberichten der Kaiserlich Akademie der Wissenschaften I Wien. Mathematisch- naturwissenschaft Klasse, Abt 1. **188**: 1461-1552.
- Höhnelt, F. von. 1919. Fragmente zur Mykologie. XXII. Mitteilung. Nr. 1154-1188. In: Sitzungsberichten der Kaiserlich Akademie der Wissenschaften I Wien. Mathematisch- naturwissenschaft Klasse, Abt 1. **198**: 535-625.
- Holmgren, P.K., and N.H. Holmgren. 1998. *Index Herbariorum: A global directory of public herbaria and associated staff* [<http://sweetgum.nybg.org/ih/>]. New York Botanical Garden's Virtual Herbarium.
- Hosagoudar, V.B. 1994. Supplement to Hansford's "The Meliolineae Monograph II". *Sydowia Beihefte* **18**: 371-378
- Hosagoudar, V.B. 1996. *Meliolales of India*, Calcutta.
- Hosagoudar, V.B. 2000. Meliolaceae of Kerala, India. *Zoo's Print Journal* **17**: 747-751.
- Hosagoudar, V.B., and D.K. Agarwal. 2008. *Taxonomic Studies of Meliolales - Identification Manual*, International Book Distributors, Dehradun, India.

- Hosagoudar, V.B., T.K. Abraham and P. Pushpangadan. 1997. *The Meliolineae - a Supplement*. Tropical Botanic Garden and Research Institute, Kerala, India.
- Hu, Y. 1996. Meliolales I. *Flora Fungorum Sinicorum* **4**: 1-270.
- Hu, Y. 1999. Meliolales II. *Flora Fungorum Sinicorum* **11**: 1-252.
- Hughes, S.J. 1953. Fungi from the Gold Coast II. *Mycological Papers Commonwealth Mycological Institute* **50**: 1-20.
- Hughes, S.J. 1976. Sooty moulds. *Mycologia* **68**: 693-80.
- Hughes, S.J. 1993. Contribution toward a monograph of *Meliolina*. *Mycological Papers Commonwealth Mycological Institute* **166**: 1-255.
- Katumoto, K. and V.B. Hosagoudar. 1989. Supplement to Hansford's The Meliolineae monograph. *Journal Economic Taxonomic Botany* **13**: 615-635.
- Kirk, P.K. 2008. *Index Fungorum*. In: Indexfungorum.org., CAB International, UK.
- Lim, G. 1975. Some sooty molds and black mildews from Singapore and the Malay Peninsula. *Reinwardtia* **9**(2): 197-213.
- Lücking, R. 2002. Follicolous lichens: evolution and ecology of an unusual growth habit (abstract), p. 91. In: L. Ryvarden (ed.). *7th International Mycological Congress*. Oslo, Norway.
- Luttrell, E.S. 1989. Morphology of *Meliola floridensis*. *Mycologia* **81**: 192-204.
- Mibey, R.K. and D.L. Hawksworth. 1997. Meliolaceae and Asterinaceae of the Shimba Hills, Kenya. *Mycological Papers Commonwealth Mycological Institute* **174**: 1-108.
- Müller, E. and J.A. von Arx. 1973. Pyrenomycetes: Meliolales, Coniophorales, Sphaeriales, pp. 88-132. In: F.K. Sparrow (ed.). *The Fungi, an advanced treatise*, Vol. 4A. *A taxonomic review with Keys: Ascomycetes and Fungi Imperfecti*. Academic Press, New York.

- Pfister, D.H. 1985. A bibliographic account of exsiccatae containing fungi. *Mycotaxon* **23**: 1-139.
- Punithalingam, E. 1981. Studies on Sphaeropsidales in culture. III. *Mycological Papers, Commonwealth Mycological Institute* **149**: 1-41, 17 plates.
- Reynolds, D.R. 1972. Stratification of tropical epiphylls. *Kalikasan, Philippine Journal of Biology* **1**: 7-10.
- Reynolds, D.R. 1978. Foliicolous Ascomycetes 1: The capnodiaceous genus *Scorias*. *Natural History Museum of Los Angeles County Contributions in Science* **288**: 1-16.
- Reynolds, D.R. 1982. Foliicolous Ascomycetes 4: The capnodiaceous genus *Trichomerium* Spegazzini emend. *Mycotaxon* **14**: 189-220.
- Reynolds, D.R. 1989a. An extenditunicate ascus in the ascostromatic genus *Meliolina*. *Cryptogamie, Mycologie* **10**: 305-320.
- Reynolds, D.R. 1989b. *Briania*, gen. nov. and *Briania fruticetum* sp. nov. *Pacific Science* **43**: 161-165.
- Reynolds, D.R. 1998. *Limaciniaseta*, gen. nov., a California sooty mold. *Madroño* **45**: 250-254.
- Reynolds, D.R. and G. Gilbert. 2005. Epifoliar fungi from Queensland, Australia. *Australian Systematic Botany* **18**: 265-289.
- Rodríguez, J.D. 2001. Acerca de la relación taxonomía-especificidad en Meliolales (Ascomycota). *Revista del Jardín Botánico Nacional* **22**: 101-108.
- Rodríguez, J.D. 2006. *Meliolaceae aus Panama* [Doctoral dissertation]. J.W. Goethe-Universität Frankfurt am Main, Germany.
- Roze, E. 1868. Contribution a l'étude de la fumagine, appelée aussi morfée, maladie du noir. *Bulletin de la Société Botanique de France* **14**: 15-21.
- Saccardo, P.A. 1897. *Sylloge Fungorum. Index universalis et locupletissimus generum, specierum, suspecierum, varietatum, hospitumque intoto opera expositorum*, vol. 12. 1053 pp.

- Saccardo, P. 1918. Notae mycologiae, ser. 24. I. Fungi Singaporensis Bakerianai. *Bollettino dell'orto Botanico della R. Università di Napoli* **6**: 39-65.
- Saenz, G.S. and J.W. Taylor. 1999. Phylogenetic relationships of *Melila* and *Meliolina* inferred from nuclear small subunit rRNA sequences. *Mycological Research* **103**: 1049-1056.
- Singh, S.K., P.N. Singh and P. Mishra. 2006. Observations on Indian foliicolous fungi. *Journal of Mycological Plant Pathology* **36(1)**:101-103.
- Sipman, H.J.M. 2003a. New species of *Cryptothecia*, *Lepraria* and *Ocellularia* (Lichenized Ascomycetes) from Singapore. In: Jensen (ed). *Lichenological contributions in honor of G.B. Feige. Bibliotheca Lichenologica* **86**: 177-184.
- Sipman, H.J.M. 2003b. Key to the lichen genera of Bogor, Cibodas and Singapore. In: www.bgbm.org/Sipman/keys/javagenera.htm, Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin, Berlin.
- Sipman, H.J.M. 2007. Singapore lichens. In: www.bgbm.org/BGBM/STAFF/Wiss/Sipman/Zschackia/Singa/Coenogonium.htm.
- Sivanesan, A. 1984. *The Bitunicate Ascomycetes and their Anamorphs*, J. Cramer, Vaduz.
- Stevens, F.L. 1926. Hawai'i Fungi. *Bulletin Bishop Museum* **19**: 1-189.
- Stevens, F.L. 1927. The Meliolineae I. *Annales Mycologici* **25**: 405-469.
- Stevens, F.L. 1928. The Meliolineae II. *Annales Mycologici* **26**: 165-383.
- Stevenson, J.A. .1975. The fungi of Puerto Rico and the American Virgin Islands. *Reed Herbarium Contribution* **23**: 1-743.
- Sutton, B. 1977. Coelomycetes. VI. Nomenclature of generic names proposed for Coelomycetes. *Mycological Papers, Commonwealth Mycological Institute* **141**: 1-253.
- Sydow, H. and P. Sydow. 1917. Beiträge zur Kenntnis der Pilzflora der Philippinen-Inseln. *Annales Mycologie* **15**: 165-208.

- Sydow, H. and P. Sydow. 1920. Notizen über einige interessante oder wenig bekannte Pilze. *Annales Mycologici* **18**: 178-187.
- Taylor, T.N., E.L. Taylor and M. Krings. 2009. Paleobotany. The biology and evolution of fossil plants. 2nd ed. Elsevir, Amsterdam.
- Thaung, M.M. 2006. Biodiversity of phylloplane Ascomycetes in Burma. *Australasian Mycologist* **24**: 5-23.
- Thumen, F. de. 1879. Mycothea Universalis. Centuria 14: 1352. (exsiccatum). Wien.
- Yamamoto, W. 1957. Formosan Meliolaceae (Meliolineae). VII. *Science Reports Hyogo University of Agriculture* **3**: 19-22.
- Wolf, K.H., M. Gouy, Y.-W. Yang, P.M. Sharp and H.-H. Li. 1981. Date of the monocot-dicot divergence estimated from chloroplast DNA sequence data. *Proceedings of the National Academy of Sciences USA* **86**: 6201-6205.
- Yamamoto, W. 1957. Formosian Meliolaceae VII. *Science Reports Hyogo University of Agriculture* **3**: 19-22.

